

U.S. Patent Application No. 10/629,962
Amendment dated July 6, 2004
Reply to Office Action dated April 6, 2004

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

Claims 1-23 (canceled)

Claim 24 (withdrawn): A method of making a zirconium basic carbonate comprising titrating an aqueous slurry of sodium zirconium carbonate to a pH of from about 3.5 to about 4.0 with a acidic agent, wherein said sodium zirconium carbonate has a moisture content of from about 15% to about 25 % LOD in solid form;

and washing said aqueous slurry containing the zirconium basic carbonate with water.

Claim 25 (withdrawn): The method of claim 24, further comprising recovering said zirconium basic chloride wet powder from said slurry.

Claim 26 (withdrawn): The method of claim 25, wherein said recovery occurs by a vacuum filtration.

Claim 27 (withdrawn): The method of claim 25, wherein said recovery occurs by centrifuging.

Claim 28 (withdrawn): A zirconium basic carbonate having:

Na^+ of less than about 1000 ppm;

a ZrO_2 wt% of from about 35 wt% to about 40 wt%;

and a CO_3^{2-} of from about 8 wt% to about 10 wt%, based on the weight of the zirconium basic carbonate.

Claim 29 (withdrawn): The zirconium basic carbonate of claim 28, wherein said zirconium basic carbonate has about 0 wt% SO_4^{2-} and about 0 wt% Cl^- .

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Claim 30 (withdrawn): The method of claim 24, wherein said sodium zirconium carbonate is formed by heating a mixture of zirconium oxychloride and soda ash at a sufficient temperature and for a sufficient time to form said sodium zirconium carbonate.

Claim 31 (withdrawn): The method of claim 30, further comprising, after heating, filtering off the sodium zirconium carbonate and washing any chloride or impurities from said sodium zirconium carbonate;

titrating an alkaline slurry comprising said sodium zirconium carbonate with at least one acidic agent to obtain a pH below about 7.0;

filtering off said sodium zirconium carbonate and washing said sodium zirconium carbonate; and

drying said sodium zirconium carbonate for a sufficient time to obtain a free flowing powder;

wherein after drying, sodium zirconium carbonate has a moisture content of from about 10% LOD to about 60% LOD.

Claims 32-34 (canceled)

Claim 35 (currently amended): A method of making zirconium phosphate comprising treating sodium zirconium carbonate with caustic soda to form alkaline hydrous zirconium oxide;

heating a slurry comprising said alkaline hydrous zirconium oxide and adding phosphoric acid; and

recovering said an acid zirconium phosphate.

Claim 36 (original): The method of claim 35, further comprising titrating an aqueous slurry of said acid zirconium phosphate with caustic soda to obtain a pH of from about 5 to about 6 and; recovering said titrated zirconium phosphate.

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Claim 37 (original): The method of claim 36, further comprising filtering said titrated zirconium phosphate and washing the filtered zirconium phosphate.

Claim 38 (original): The method of claim 37, further comprising drying said zirconium phosphate to obtain a free flowing powder.

Claim 39 (original): The method of claim 38, wherein said zirconium phosphate has a moisture level of from about 12% to about 18% LOD.

Claim 40 (original): The method of claim 37, wherein said the washing of the titrated zirconium phosphate is with RO water sufficient to obtain a 300 ppm or less Total Dissolved Solid and minimize leachable Na⁺.

Claim 41 (original): The method of claim 36, wherein said caustic soda is a 50% caustic soda.

Claim 42 (original): The method of claim 35, wherein said heating is at a temperature of from about 180 °F to about 185 °F for one hour.

Claim 43 (original): The method of claim 35, wherein said sodium zirconium carbonate is obtained from heating zirconium oxychloride with soda ash at a sufficient temperature and for a sufficient time to form the sodium zirconium carbonate.

Claim 44 (original): The method of claim 43, wherein said heating of zirconium oxychloride is at a temperature of from about 150 °F to about 250 °F.

Claim 45 (original): The method of claim 43, further comprising, after heating of the zirconium oxychloride with soda ash to form the sodium zirconium carbonate, filtering off and washing said sodium zirconium carbonate to remove any chloride or impurities from said sodium zirconium carbonate.

Claim 46 (currently amended): A zirconium phosphate having a Na⁺ wt% of from about 4

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wt% to about 6 wt%;

a ZrO₂ wt% of from about 34 wt% to about 37 wt%;

a PO₄ wt% of from about 41 wt% to about 43 wt%; and

a H₂O wt% of from about 14 wt% to about 18 wt%, based on the weight of the zirconium phosphate.

Claim 47 (original): The zirconium phosphate of claim 46, wherein said zirconium phosphate has at least one of the following characteristics:

a) an adsorption capacity for ammonia of from about 30 mg NH₄N/gm ZrP to about 35 mg NH₄N/gm ZrP;

an adsorption capacity for Ca²⁺ of from about 3 mEq Ca²⁺/gm ZrP to about 5 mEq Ca²⁺/gm ZrP;

an adsorption capacity for Mg²⁺ of from about 2 mEq Mg²⁺/gm ZrP to about 3 mEq Mg²⁺/gm ZrP; and

an adsorption capacity for toxic heavy metals of from about 5 mEq HM/gm ZrP to about 7 mEq HM/gm ZrP;

b) a Na⁺ content of from about 2 mEq Na⁺/gm ZrP to about 3 mEq Na⁺/gm ZrP at a pH of from about 5.75 to about 6;

c) a minimum leachable PO₄³⁻ of less than about 0.05 mg PO₄³⁻/gm ZrP; or

d) satisfying ANSI/AAMI RD-5-1992 standard on extractable toxic impurities.

Claim 48 (original): The zirconium phosphate of claim 46, wherein said zirconium phosphate has no residual sulfate or chloride.

Claim 49 (original): The zirconium phosphate of claim 46, wherein said zirconium phosphate has less than 0.01% sulfate, chloride, or both.

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Claim 50 (original): The zirconium phosphate of claim 46, wherein said zirconium phosphate is H₂O has a pH of from about 6 to about 7.

Claim 51 (original): The zirconium phosphate of claim 46, wherein said zirconium phosphate has an average grain size of from about 30 to about 40 microns.